DOCUMENT RESUME

ED 133 504 CE 009 369

TITLE Painting Services: An Instructor's Guide for a Program in Trade and Technical Education. Automotive Industries Occupations.

INSTITUTION New York State Education Dept., Albany. Bureau of Occupational and Career Curriculum Development.

PUB DATE 76
NOTE 57p.

EDRS PRICE MF-$0.83 HC-$3.50 Plus Postage.
DESCRIPTORS *Auto Body Repairmen; *Auto Mechanics (Occupation); *Curriculum; Curriculum Guides; *Job Training; *Painting; Post Secondary Education; Secondary Education; Teaching Guides; Technical Education; Trade and Industrial Education; Units of Study (Subject Fields)

ABSTRACT

Designed to assist instructors in preparing secondary and adult students for employment in the field of auto damage correction, as automotive refinishers, this guide outlines six units of instruction. (It was developed as one part of a three-part, 2-year course in auto damage correction: Body services, frame services, and painting services.) The six unit titles are: (1) Introduction (overview of the course content and requirements, work and safety habits, and introduction to auto refinishing), (2) Automotive Paint Shop Layout, Materials, and Equipment, (3) Surface Preparation, (4) Undercoats, (5) Topcoats, and (6) Decorative Finishes. Methods and materials are suggested for enriching the course and achieving a more effective presentation. A two-column format is used: the left-hand column contains suggested topics which are keyed to specific objectives; the right-hand column gives related factual information, as well as instructional suggestions and page references for selected textbooks. At the conclusion of each unit, topics for review discussion are included. A sample final examination is also provided. A list of suggested aids is given in the bibliography: Textbooks, reference books, booklets and charts, films, filmstrips, slides, film loops, and transparencies. (WL)

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Automotive Industries Occupations

ED133504

AN INSTRUCTOR'S GUIDE FOR A PROGRAM IN

PAINTING SERVICES

TRADE AND TECHNICAL EDUCATION

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THE UNIVERSITY OF THE STATE OF NEW YORK / THE STATE EDUCATION DEPARTMENT
BUREAU OF OCCUPATIONAL EDUCATION CURRICULUM DEVELOPMENT/Albany, N.Y. 12234
1976

FOREWORD

Painting Services was developed from the suggested paint services that are listed in the *Auto Damage Correction Occupations*. The content may be used in secondary schools and adult programs to assist in preparing individuals who wish to enter the field of auto damage correction as an automotive refinisher.

Appreciation is expressed to Warren Simpson, auto body instructor at Rensselaer County BOCES at Troy, for his efforts in developing the instructional materials. Assistance relating to content was provided by Charles A. Stebbins, associate in the Bureau of Trade and Technical Education. The project was coordinated and the manuscript prepared for publication by Nelson S. Maurer, associate in the Bureau of Occupational Education Curriculum Development.

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MESSAGE TO INSTRUCTORS

Painting Services is designed to assist you in preparing your students for employment in a specialized area of automotive services. Units are planned to be presented as listed in the publication, but the sequence may be altered to accommodate the needs and background of the trainees. The availability of tools and equipment also may necessitate adaptations in the use of the materials.

The program of Auto Damage Correction is organized into three parts — Body Services, Frame Services, and Painting Services. This course, *Painting Services*, can be utilized as part of a major sequence when offered in conjunction with the other two parts in the program; namely, Body Services and Frame Services. The program should be offered for at least 2 years with a maximum of two credits granted for each year of 160 days of instruction at 2½ hours a day. Two such academic years of study would satisfy the requirements for a Group II sequence as outlined in the *Secondary School Curriculum of New York State; A Handbook for Administrators*.

The three parts of the program may be presented in any order but their contents should be covered in a 2-year period. Local schools that conform to this program may presume to have the approval to grant State diploma credit. Local schools that wish to offer instruction different from that listed in the suggested outline of services for *Auto Damage Correction Occupations* should submit a course of study to the Bureau of Occupational Curriculum Development for specific review and approval.

This guide suggests methods and materials that should enrich a course and help achieve a more effective presentation. The general objectives for each unit are stated in terms of performance activities that the student is able to do as a result of the instruction. The standards, as determined by the instructor, should be at least the minimum proficiency necessary for entry employment in the area of automotive finishing. The instructor may develop more detailed objectives and these also should be stated as observable behavior exhibited by the learner when applying the acquired skills and knowledges.

The guide uses a two-column format. The left-hand column contains suggested topics which are keyed to specific objectives; the right-hand column gives related factual information, as well as instructional suggestions and page references for selected textbooks. At the conclusion of each unit, topics for review discussion are included. A sample final examination is also provided. Additional help in test construction procedures may be obtained from *Improving the Classroom Test* published by the State Education Department, Bureau of Elementary and Secondary Educational Testing, Albany, New York. A list of suggested aids which will help to clarify the presentation of the material is given in the bibliography.

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INTRODUCTION

Gives an overview of the course content and requirements, discusses important work and safety habits, and provides an introduction to automotive refinishing

OBJECTIVES

At the completion of this unit students will be able to:

1 Assess the value of the course in meeting their perceived occupational needs

2 Demonstrate appropriate work habits and attitudes during their training and on the job

3 Use, store, and dispose of flammable liquids and materials commonly used in the automotive paint shop in a safe manner

4 Maintain clean conditions and follow safe procedures when working in an automotive paint shop

5 Explain the purposes of the ingredients used in automotive finishes

6 Explain the purposes and uses of different kinds of undercoats

7 Explain the purposes and uses of different types of topcoats

8 Explain how to prepare automotive finishes for use

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
I. Importance (1)	Point out that the finish on an automobile begins to deteriorate almost as soon as the vehicle is put into service. The film of the finish may be broken by stones being thrown from the tires of passing cars, by bumps received in parking lots from the doors of other cars and shopping carts, and by vandalism. The wise car owner has these minor nicks and scratches fixed before more extensive damage takes place. As the number of vehicles increases, the chances of being involved in an accident become greater. Such accident damage usually requires body work and repainting. Also, some vehicles are refinished to bring back the luster that the car had when it was new or to change the color of the car. Thus, there is a need and opportunity for individuals who are able to perform quality painting services.

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
I. Importance (1) (cont'd)	The purposes of the course are: • To provide individuals who are working in the automotive field as well as other interested persons with the opportunity of gaining new knowledge and skills which will permit them to enter the specialized area of automotive painting services. • To provide training in automotive painting services for students in vocational and occupational education programs
II. Overview of Course (1)	Indicate that the course will cover all areas of automotive painting including preparing the surface, sanding and featheredging, applying undercoats, applying enamel and lacquer topcoats, sanding and polishing topcoats, and using decorative finishes. Point out that each student will learn the theory from class presentations and textbooks and then will have the opportunity to apply this knowledge by working on live jobs. Indicate also such items as the length of each session, the number of sessions, the procedures to be followed in class, the reasons for homework, and in general, the expectations for each class member. Emphasize that there will be quizzes throughout the course as well as a final examination. When possible, provide time immediately following the final examination for a review of the test and for answering questions about the course.
A. Individual needs	Find out from the students their backgrounds and needs. Use this information to adapt the course content to meet as many of the individual needs as possible, keeping in mind the equipment available. Develop a card data file for each student listing name, address, telephone number, needs, goals, training, work experience, and other pertinent information. This file will be valuable in giving individual aid during the course. Also, it will help to maintain contact with students after they are employed. Many times former students can provide up-to-date trade information, training aids, and placement assistance.

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
B. Work habits and attitudes (2)	Discuss the importance of good work habits and show how these might aid an individual in maintaining and improving his position. Include such items as: • Sense of responsibility to employer and other employees • Appreciation of safety rules and regulations • Accuracy and speed Discuss the attitudes that employers expect to find in employees. Indicate that many times the cause of a worker's dismissal is related to his poor work habits and not to his lack of skills or ability. Emphasize the importance of developing good work habits and desirable attitudes during the course. (Ref. What Employers Want; Why Young People Fail to Get and Hold Jobs)
III. Course Requirements	
A. Textbook	If a textbook is to be used, give its title, price, and source. Arrange for a group order.*
B. Notebook	Indicate that a looseleaf notebook is necessary for keeping class notes, job information, manuals, booklets, and other materials distributed during the course.
C. Work clothes	Point out the necessity of wearing coveralls during the work sessions. Indicate some local sources and approximate prices.
IV. Hazards (3)	Discuss the different hazards involved in automotive spray painting. Include such items as the toxic effects of overexposure to paint solvents, danger from fire and explosion, and the recommended ways of reducing or eliminating these hazards by having adequate ventilation and using the correct procedures for handling and storing flammable liquids. (Ref. A, p. 36; Binks Bulletin TD - 100-3)

* Reference citations are shown on page 45.

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
IV. Hazards (3) (cont'd)	*Check constantly to see that students use, store, and dispose of flammable materials in a safe manner.* Discuss the OSHA regulations that relate to the ventilation of spray booths, containers for flammable and combustible liquids, and spray finishing. These may be found in the *Code of Federal Regulations, 29 Labor, Part 1910.* Discuss and show how to control and extinguish fires in the paint shop. Show the locations of extinguishers in the paint shop.
V. Work Procedures (4)	Discuss the importance of following safe work procedures. Include such items as: • Keeping aisles, walkways, and exits free of materials and obstructions • Having all exits clearly marked • Maintaining clean floors by wiping up immediately any spilled oil, paint, solvent, or other materials that would cause the floor to become slippery • Storing tools and equipment in specific places and in a safe manner • Storing flammable liquids and materials in closed metal containers • Using only electrical equipment that has the cord in good condition, tight electrical connections, and a grounded plug • Avoiding the use of makeshift electrical hookups • Using ground wires to prevent the discharge of static electricity • Not smoking while in the paint shop (Ref. D, p. 25) Discuss the need and uses of the various types of safety equipment recommended by OSHA for different situations encountered in automotive spray painting. Point out where the respirators and filter masks are kept in the shop. (Ref. A, p. 37; Binks Bulletin TD - 9-1R) Code of Federal Regulations, 29 Labor, Part 1910)

CONTENT OUTLINE		INSTRUCTIONAL SUGGESTIONS
V.	Work Procedures (4) (cont'd)	Stress the importance of checking paint booth filters prior to each use and of changing them when necessary. (Ref. A, p. 37) Emphasize the necessity of wearing rubber gloves when using caustic solvents and chemicals. Point out where the rubber gloves are kept in the shop. Explain the regulations established by the school district relative to eye safety that pertain to the automotive paint shop. Point out where the safety glasses, goggles, and shields are kept in the shop. Arrange for a group purchase of approved safety glasses for those who wish to have their own glasses. Discuss the procedures to follow when someone receives an injury in the paint shop. Discuss the dangers and consequences of horseplay. Ask students to relate their experiences with accidents and have them indicate the procedures that should have been followed. *Use films, filmstrips, or transparencies that deal with safety to emphasize the importance of practicing safe work procedures when doing any type of painting or refinishing.*
VI.	Automotive Finishes	Discuss the purposes of automotive finishes. Point out that an automotive finish consists of an undercoat and a topcoat.
	A. Ingredients (5)	Discuss the functions of the various ingredients used in automotive finishes including: • Pigment • Binder • Thinner or solvent (Ref. D, pp. 21-22)
	B. Undercoats (6)	Explain the functions of undercoats. Discuss the purposes and uses for the following: • Primer • Primer-surfacer

CONTENT	INSTRUCTIONAL SUGGESTIONS
	• Sealer and bleeder-sealer • Refinishing putty (Ref. A, pp. 6-8; Ref. C, p. 10; Ref. D, p. 22)
C. Topcoats (7)	Explain the functions of the topcoats. Discuss the basic types of topcoats and explain the characteristics and uses of each. (Ref. D, pp. 23-24, 36-37)
D. Preparation (8)	Explain why it is important to follow the manufacturer's directions when preparing automotive finishes for use. Point out that a common error is the failure to stir the paint thoroughly before using it. (Ref. D, p. 26)

Review Discussion

1. List four personal safety devices that an automotive painter may use to protect himself when working with paints, solvents, and metal conditioners.
2. List five safe practices to follow when working with solvents and other flammable materials.
3. List five hazards that should be eliminated from an automotive paint shop.
4. List five safe practices that should be followed when working in an automotive paint shop.
5. Name three ingredients used in automotive finishes and the functions of each.
6. State the functions of the primer-surfacer.
7. Explain the purpose of the topcoat.
8. Name two types of automotive topcoats and uses for each.
9. Explain the difference between enamel and lacquer automotive finishes.
10. Explain the importance of maintaining good work habits on the job.

AUTOMOTIVE PAINT SHOP LAYOUT, MATERIALS, AND EQUIPMENT

Indicates the need for specific work areas in an automotive paint shop and explains how to select, use, and care for the various materials and equipment used by an automotive refinisher

OBJECTIVES

At the completion of this unit students will be able to:

1 *Explain the need for specific areas for specialized work in an automotive paint shop*

2 *Select and use various types of paint shop materials including cloths, wipers, squeegees, and masking papers and tapes*

3 *Care for a compressor and air lines and adjust the regulator to obtain the correct air needs for an automotive paint shop*

4 *Identify and explain the operation of different types of spray guns*

5 *Select, adjust, and regulate spray guns to produce desired spray patterns*

6 *Use spray guns in the correct manner*

7 *Identify and remedy faulty spray patterns*

8 *Clean and store spray guns*

9 *Identify the different abrasive grit sizes and select the appropriate types of coated abrasives necessary for various kinds of refinishing jobs*

10 *Select and use various types of sanding equipment for different kinds of sanding operations*

11 *Select and use, from those available, heat lamps that are adequate for specific automotive paint jobs*

12 *Provide adequate ventilation for the shop and painting area*

13 *Check and change, when necessary, spray booth filters*

CONTENT		INSTRUCTIONAL SUGGESTIONS
I.	Paint Shop Layout (1)	Explain why different areas are needed in an automotive paint shop and discuss how they are arranged for an efficient flow of work including space for: • Cleaning • Sanding and priming • Masking • Spraying • Drying • Compounding and final cleaning (Ref. A, pp. 23-26; Ref. C, p. 34)*
II.	Paint Shop Materials (2)	Explain how to select and use paint shop materials including the following: • Cleaning cloths and wipers • Tack cloths • Squeegees • Strainers • Masking papers and tapes (Ref. A, pp. 9-14)
III.	Paint Shop Equipment	
	A. Compressed air system (3)	Discuss the functions of the various parts of a compressed air system including: • Compressor • Regulator or transformer • Water separator • Air hoses (Ref. A, pp. 23-23; Ref. E, pp. 187-189)

* Reference citations are shown on page 45.

CONTENT		INSTRUCTIONAL SUGGESTIONS
A.	Compressed air system (3) (cont'd)	Explain and demonstrate how to care for the compressor, change oil, drain water from air lines and pressure tank, and adjust the regulator. (Ref. C, pp. 6-7, Ref. E, pp. 185-188) Discuss the safety precautions to take when using a compressor.
B.	Spray gun (4)	Discuss the basic types of spray guns and the operations of each. (Ref. E, pp. 180-182) Explain how to select spray guns for specific types of paint jobs.
	1. Parts (4)	Discuss the functions of the various parts of a general purpose spray gun including: • Air nozzle or cap • Fluid nozzle or tip • Fluid needle valve • Fluid adjustment screw • Air valve • Spreader adjustment valve • Trigger (Ref. A, p. 28; Ref. B, p. 209; Ref. C, p. 6; Ref. E, p. 182)
	2. Inspection and adjustment (5)	Explain and demonstrate how to inspect and adjust a spray gun to obtain the desired spray pattern including: • Air pressure • Pattern adjustment • Fluid adjustment (Ref. A, pp. 29-31; Ref. B, pp. 213-124)
	3. Use (6)	Explain and demonstrate how to use a spray gun including: • Holding • Releasing the trigger

CONTENT		INSTRUCTIONAL SUGGESTIONS
	3. Use (6) (cont'd)	• Making first pass • Making second pass • Making final pass (Ref. A, pp. 31-34; Ref. B, pp. 209-211, 214-215, 222-225; Ref. C, pp. 8-9; Ref. D, pp. 8-10; Ref. E, pp. 194-197)
	4. Spray patterns (7)	Demonstrate how to correct faulty spray patterns. (Ref. A, pp. 33-34; Ref. B, p. 221; Ref. C, p. 5; Ref. E, p. 196)
	5. Care and cleaning (8)	Demonstrate how to care for and clean a spray gun. (Ref. A, pp. 33-34) Explain why it is important to keep spray guns in good operating conditions. Review how to dispose of and store unused paints and thinners. *Check often to see that students are cleaning and caring for their spray guns properly.*
C.	Coated Abrasives (9)	Discuss how the proper selection and use of coated abrasives affects the time required to do a specific job as well as the quality of the final finish. (Ref. C, pp. 27-30) Explain that while sandpaper is a commonly used term, it is not correct because sand is not used as an abrasive material. The term to use is coated abrasives, and this applies to all types of abrasives used in automotive refinishing such as abrasive paper, waterproof paper, discs, and belts. (Ref. E, pp. 30-31)
	1. Materials	Discuss the different types of materials used in making coated abrasives and the uses of each. Discuss the selection of the proper materials for differed kinds of jobs. (Ref. E, pp. 30-31; A Guide to Better Automotive Refinishing, p. 13)
	2. Grit sizes	Explain the grit sizes used in coated abrasives. Discuss the selection of the proper grit size for different types of jobs. (Ref. A, p. 46; Ref. E, pp. 31-33; A Guide to Better Automotive Refinishing, p. 9)

CONTENT		INSTRUCTIONAL SUGGESTIONS
	3. Backing materials	Explain the different kinds of backing materials used in making coated abrasives and the uses of each. Discuss the selection of the proper backing for different types of jobs.
	4. Bonding materials	Explain the different types of bonding materials used to fasten the abrasive grains to the backing and the uses of each. Discuss the selection of the proper bond for different kinds of jobs.
	5. Coating methods	Explain the different methods of covering the backing with abrasive grains and the uses of each. Discuss the selection of the proper coating for different types of jobs. Explain and demonstrate how to select and use different types and sizes of coated abrasives to sand by hand and machine including: • Coarse sanding • Scuff sanding • Light sanding • Thorough sanding • Featheredging
D.	Sanding equipment (10)	Discuss the different types of sanding equipment used to remove old finishes and smooth surfaces prior to being refinished.
	1. Disc sanders	Explain and demonstrate how to use a disc sander. Discuss and show how to select sanding discs for use with disc sanders. Demonstrate how to change an abrasive disc on a disc sander.
	2. Finishing sanders	Explain and demonstrate the uses of the different types of finishing sanders used in automotive refinishing. Discuss the hazards of using electric powered sanders when wet sanding. Discuss and show how to select coated abrasives for use with finishing sanders. Demonstrate how to change a sheet of coated abrasive on a finishing sander.

CONTENT	INSTRUCTIONAL SUGGESTIONS
E. Heating lamps (11)	Explain the functions of heating lamps and demonstrate how to select and use them for: • Primers • Primer-surfacers • Topcoats (Ref. A, p. 24; Ref. E, pp. 190-192) Discuss the safety precautions to take when using heating lamps.
F. Exhaust fans (12)	Discuss the importance of maintaining adequate ventilation and dust free conditions during the painting operations.
C. Spray booth fillers (13)	Show how to check and change the filters on spray booths.
	Have students practice adjusting and using spray guns to paint prepared panels. Observe each student's work to see that proper procedures are being followed. When necessary, assist students to improve their techniques. (Ref. B, pp. 224-226)
	Have students set up heating lamps to dry the practice panels they have painted.
	Check to see that students are cleaning their spray guns and disposing of unused paints and thinners properly.

Review Discussion

1. Explain why various areas for specific work are needed in automotive paint shops.
2. Explain how to care for an air compressor in an automotive paint shop.
3. Explain the safety precautions to follow when using heating lamps in an automotive paint shop.
4. Explain the different grit sizes of coated abrasives that are used in a refinishing job.
5. List the safety precautions to take when spraying paint.
6. Explain how to adjust and clean a spray gun.
7. Explain how to hold and use a spray gun.
8. Describe four faulty spray patterns and explain how to correct each.

SURFACE PREPARATION

Explains how to select the appropriate method to correct various kinds of damage, identify the type of finish now on the vehicle, clean the area that needs repairing, remove the present finish, and prepare the metal surface for the undercoats

OBJECTIVES

At the completion of this unit students will be able to:

1. *Select the appropriate refinishing procedures to correct various kinds of auto damage*
2. *Determine the amount of preparation work needed to satisfactorily correct different kinds of auto damage*
3. *Use the information found on a vehicle's color identification plate to assist in determining the type and kind of finish presently on a vehicle*
4. *List and order the materials needed to refinish different kinds of auto damage*
5. *Remove the necessary hardware prior to preparing surfaces for refinishing*
6. *Clean surfaces around areas being repaired*
7. *Remove old finishes using paint removers, solvents, and coated abrasives*
8. *Clean and prepare metal surfaces for undercoats*
9. *Featheredge original paint surfaces around the area being repaired*

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
I. Procedures for Refinishing (1)	Discuss the refinishing procedures available to an automotive painter to correct different kinds of auto damage including: • Spot • Panel • Complete repainting

CONTENT OUTLINE		INSTRUCTIONAL SUGGESTIONS
I.	Procedures for Refinishing (1) (cont'd)	Discuss the factors an automotive painter needs to consider when selecting the appropriate refinishing procedures needed to correct different kinds of auto damage. (Ref. A, pp. 43-44)*
II.	Preparation Work Needed (2)	Discuss why it is important to carefully judge the condition of a vehicle's paint surface in order to determine the amount of preparation work necessary to satisfactorily correct the auto damage. (Ref. D, p. 13)
III.	Present Finish (3)	Show the locations used by different manufacturers of the color identification plate. Explain how to use this information to assist in identifying the type of finish that is now on a vehicle and determining if it is original, faded, or different. (Ref. A, p. 42; Ref. C, p. 12)
IV.	Materials Needed (4)	Explain how to select and order the refinishing materials needed for a job including: • Primers • Sealers • Topcoats (Ref. A, pp. 40-41; Ref. D, pp. 36-37)
V.	Removal of Hardware (5)	Explain and demonstrate how to remove the necessary hardware such as chrome, hood and deck lid ornaments, and nameplates.
VI.	Cleaning the Surface (6)	Explain why it is necessary to throughly clean the surface prior to refinishing it. Discuss how an improperly cleaned surface may ruin a paint job. (Ref. C, pp. 12-13;) Demonstrate how to clean a paint surface by washing and using a cleaning solvent. (Ref. A, pp. 45-49; Ref. D, pp. 14-18) Show how to remove the excess water and cleaner with a squeegee and dry the surface with cloths.
VII.	Paint Removal (7)	Demonstrate how to remove the old finish with: • Coated abrasives (disc sanders) • Paint removers

* Reference citations are shown on page 45.

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
	• Solvents (lacquer) (Ref. A, pp. 46-49; Ref. C, p. 14; Ref. E, pp. 27-35) Discuss the safety precautions to take when using paint removers, solvents, and disc sanders.
VIII. Metal Surface Preparation (8)	Explain and demonstrate how to clean and condition the bare metal prior to its being refinished. (Ref. A, pp. 49-50) Discuss the safety precautions to take when working with metal conditioners.
IX. Featheredging (9)	Explain why it is important to correctly feather the edge of the original finish in the area being refinished. Demonstrate how to select and use coated abrasives to feather an edge by: • Hand • Block • Machine (oscillating and orbital sanders) (Ref. A, p. 46; Ref. E, pp. 29-31, 171-172) Show how to dry and clean the surface after it has been wet sanded. Develop a chart with the help of students that summarizes the operations related to surface preparations. Duplicate and distribute this information to students. (Ref. A, p. 51) *Use transparencies, filmstrips, and slides to assist in the presentation of this topic.* *Have the students practice selecting and ordering refinishing materials for various types of jobs and preparing surfaces for refinishing. Check each student's work to see that correct procedures are being followed.*

Review Discussion

1. Explain the factors to consider when selecting appropriate refinishing procedures needed to correct different types of auto damage.

Review Discussion (cont'd)

2. Explain how to identify the type of finish that is on a vehicle.

3. Explain when and how to use solvents to clean surfaces prior to refinishing them.

4. Explain the purposes of a paint solvent and the conditions under which it is used.

5. Explain how to identify the type and color of finish that is presently on a vehicle.

6. State the safety precautions to take when using paint removers and lacquer solvents.

7. Explain the importance of preparing the metal surface for refinishing.

8. List the grits of the different abrasive papers to use when removing an old finish.

9. Explain how to feather an edge.

10. Explain why it is important to use a sanding block when feather-edging by hand.

UNDERCOATS

Explains the purposes and types of undercoats and how to apply them

OBJECTIVES

At the completion of this unit students will be able to:

1. Explain the purposes of undercoats
2. Select the appropriate type of undercoat for each repair job
3. Protect surfaces not being refinished by masking
4. Prepare and apply satisfactorily different types of undercoats
5. Clean spray guns and dispose of and store unused undercoats
6. Identify and correct problems caused by improper thinning and faulty application of different types of undercoats
7. Use dry and waterproof coated abrasives to smooth undercoats

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
I. Undercoats (1)	Explain the purposes of undercoats. (Ref. A, p. 53)*
	Discuss how a poorly mixed and improperly applied undercoat affects the final finish
	Discuss why it is important to do the following when applying undercoats: • Read and follow the manufacturer's instructions • Mix and strain undercoats • Wipe and tack surfaces • Consider the temperature

* Reference citations are shown on page 45.

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
A. Primer (2)	Explain the functions of the primer, including such items as: • Adhesion for the topcoat • Prevention of rust and corrosion (Ref. D, p. 27) Discuss the characteristics and uses of the following: • Lacquer primer • Enamel primer • Special primers (Ref. A, pp. 54-56, 59-61, 64)
B. Primer-surfacer (2)	Discuss the functions of a primer-surfacer including such items as: • Adhesion for the topcoat • Prevention of rust and corrosion • Filling of minor flaws in the bare metal surface (Ref. D, p. 30) Discuss the characteristics and uses of the following: • Lacquer primer-surfacer • Enamel primer-surfacer (Ref. D, pp. 16-17)
C. Refinishing Putty (2)	Discuss the characteristics and uses of refinishing putty. (Ref. A, p. 54; Ref. C, p.16; Ref. D, p. 29)
D. Sealers (2)	Discuss the functions of sealers including such items as: • Improving adhesion between old and new finishes • Hiding sandscratches

CONTENT OUTLINE		INSTRUCTIONAL SUGGESTIONS
	D. Sealers (2) (cont'd)	• Reducing sandscratch swelling • Giving topcoat good "hold out" qualities (Ref. A, p. 58; Ref. C, p. 20; Ref. D, p. 33) Discuss when sealers *must* be used and when sealers *should* be used.
II.	Masking Surfaces (3)	Discuss the importance of masking surfaces that are not to be painted when repairing an automotive paint job. Show how to select different types of masking papers and tapes for various situations. Demonstrate the procedures to use when masking surfaces. (Ref. A, pp. 12-14; Ref. B, pp. 236-238; Ref. D, p. 19; Ref. E, pp. 159-164)
III.	Application (4-5)	Demonstrate how to select, prepare, and use the following: • Primers (all types) • Primer-surfacers • Refinishing putty • Sealers (Ref. B, pp. 225-235; Ref. D, pp. 27-34) Demonstrate how to clean a spray gun and to dispose of and store unused undercoats.
IV.	Application Problems (6)	Demonstrate how to correct problems caused by improper thinning and faulty application of undercoats. Develop a chart with the help of the students that summarizes the operations related to the application of undercoats. Duplicate and distribute this information to students. (Ref. A, pp. 62-63) *Develop panels for demonstration and discussion purposes that show the effects of:* • *Failing to use a primer-surfacer on the adhesion qualities of the topcoat* • *Bridging sandscratches caused by under-thinning of the primer-surfacer*

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
	• *Using the wrong type of thinner* • *Using too high air pressure on the adhesion qualities of the primer-surfacer* • *Sanding improperly the primer-surfacer on the gloss and holdout qualities of the topcoat.* *(Ref. Panel Preparation Guides PPG Industries)* *Have students practice applying different types of undercoats until they are able to do the job satisfactorily. Check each student's work to see that proper procedures are being followed.*
V. Sanding Surfaces (7)	Demonstrate how to select and use dry and waterproof coated abrasives for thorough sanding of different types of undercoats. (Ref. C, pp. 18-19; Ref. D, p. 20; Ref. E, p. 33) Demonstrate how to dry a surface with a squeegee and wipe with a tack cloth. *Have students practice sanding different types of undercoats until they are able to do the job satisfactorily for the application of a topcoat. Check each student's work to see that proper procedures are being followed.*

Review Discussion

1. Explain the functions of a primer.
2. Explain the functions of the primer-surfacer.
3. Name three different types of automotive sealers and uses for each.
4. Explain the purposes of the zinc chromate primer.
5. Explain the problems caused by improper thinning and the faulty application of undercoats and the necessary corrective measures to take in each case.

TOPCOATS

Discusses the various types of topcoats available and explains how to use thinners and reducers, match colors, apply and correct paint problems, polish finishes, and make estimates of refinishing jobs

OBJECTIVES

At the completion of this unit students will be able to:

1 *Explain the different types of topcoats available and uses for each*

2 *Select and use thinners and reducers properly*

3 *Select and match paint colors*

4 *Prepare surfaces and paints for spraying*

5 *Select the proper spray gun for each type of topcoat*

6 *Apply satisfactorily different types of topcoats*

7 *Identify and correct problems related to the application of topcoats*

8 *Clean spray guns and dispose of and store unused topcoats*

9 *Remove masking materials from protected surfaces.*

10 *Select and use different types of rubbing and polishing compounds*

11 *Select and use different types of polishes and waxes*

12 *Reinstall hardware that was removed prior to repainting*

13 *Clean vehicle before returning it to the owner*

14 *Estimate the cost of different kinds of refinishing jobs*

CONTENT OUTLINE		INSTRUCTIONAL SUGGESTIONS
I.	Types (1)	Explain the different types of automotive topcoats available and the uses of each.
II.	Thinners and Reducers (2)	Discuss the functions of thinners and reducers. Indicate that a thinner is never used for enamel products and a reducer is never used for lacquer products. (Ref. A, pp. 65-66; Ref. B, pp. 216-220)*

* Reference citations are shown on page 45.

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
II. Thinners and Reducers (2) (cont;d)	Discuss the factors to consider when selecting a thinner or reducer including: • Type of topcoat • Humidity • Temperature (See guide below.) (Ref. A, pp. 66-67; Ref. C, pp. 22-23, 28)

THINNER AND REDUCER GUIDE

Temperature	Solvent Evaporation Rate
60° F. and lower Cold and damp conditions	Fast
65° F. and lower	Medium-fast
65° F. and higher Normal summer conditions	Medium
65° F. and higher Normal shop conditions	Slow
65° F. and higher Hot and dry conditions	Extra slow

Explain how to reduce paints with thinners according to specified percentages that are stated on the label. (See guide below.)

Percent Reduction	Proportions
25	1 part thinner to 4 parts paint
33	1 part thinner to 3 parts paint
50	1 part thinner to 2 parts paint
100	1 part thinner to 1 part paint
150	3 parts thinner to 2 parts paint
200	2 parts thinner to 1 part paint
250	5 parts thinner to 2 parts paint
300	3 parts thinner to 1 part paint

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
II. Thinners and Reducers (2) (cont'd)	Discuss and illustrate the different kinds of paint problems that develop when the wrong thinner or reducer is used. (Ref. A, pp. 67-68)
III. Color Matching (3)	Discuss the importance of matching colors as accurately as possible. (Ref. D, pp. 35-36)
	Discuss the conditions that affect the matching of colors. (See guide below.)

VARIABLES AFFECTING COLOR MATCH

Variable	To Make Colors	
	Lighter	Darker
SPRAYING TECH.		
Gun Distance	Increase	Decrease
Gun Speed	Increase	Decrease
Flash Time Between Coats	Allow more flash time	Allow less flash time
Mist Coat	Will not lighten color	Wetter mist coat
THINNER		
Evaporation Rate	Use faster type	Use slower type
Reduction of Color	Increase amt. of thinner	Decrease amt. of thinner
Retarder	Do not use	Add to thinner
SPRAY GUN		
Fluid Tip	Use smaller size	Use larger size
Air Cap	Use cap with more holes	Use cap with less holes
Fluid Adj. Valve	Decrease material flow	Increase material flow
Fan Adj. Valve	Increase fan width	Decrease fan width
Air Pressure (at gun)	Increase	Decrease
SHOP CONDITIONS		
Temperature	Increase	Decrease
Humidity	Decrease	Increase
Ventilation	Increase	Decrease

CONTENT OUTLINE		INSTRUCTIONAL SUGGESTIONS
III.	Color Matching (3) (cont'd)	Explain and demonstrate how to match: • Solid colors • Metallic colors (Ref. A, pp. 74-77; Ref. B, pp. 239-241, Ref. C, pp. 32-33; Ref. E, pp. 175-179)
IV.	Preparation of Surfaces (4)	Discuss why it is necessary to remask when the original masking has been damaged during the sanding of the undercoat.
	A. Procedures (4)	Discuss the different factors that affect the final results such as: • Reading and following manufacturer's instructions • Mixing and straining procedures • Sanding surfaces (scuff, light, or thorough) • Tacking surfaces • Maintaining dust-free conditions • Drying conditions (temperature and humidity) (Ref. D, p. 26)
	B. Spray gun (5)	Demonstrate how to select the proper spray gun for different types of topcoats.
V.	Application (6)	Demonstrate how to apply an acrylic lacquer topcoat to a prepared surface. (Ref. A, pp. 78-79, 85; Ref. C, p. 29; Ref. D, p. 38) Demonstrate how to apply single and double coats. Discuss the purpose of a mist coat. Demonstrate how to apply a mist coat. Demonstrate how to apply an acrylic enamel topcoat to a prepared surface. (Ref. A, pp. 81-82 85; Ref. C, p. 27.) Demonstrate how to apply an alkyd enamel topcoat to a prepared surface. (Ref. C, p. 26; Ref. D, p. 37)

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
V. Application (6) (cont'd)	Demonstrate how to apply new types of topcoats to a prepared surface.
	Demonstrate how to repair a spot using the one-gun method. (Ref. A, pp. 75, 77-79; Ref. B, pp. 241-242; Ref. C, pp. 30-31; Ref. D, pp. 11-12)
	Demonstrate how to repair a spot using the two-gun method. (Ref. C, pp. 30-31)
	Discuss and demonstrate the painting sequences to use when repainting an entire vehicle. (Ref. A, pp. 81-82; Ref. D, p. 11; Ref. E, pp. 197-198)
	Develop with the students finishing schedules for various kinds of repairs using different types of automotive finishes. Duplicate and distribute this information to the students. (Ref. A, p. 85; Ref. B, pp. 248-249; Ref. C, pp. 35-42)
	Develop with students a chart that lists the common automotive refinishing products along with their uses and trade names. Duplicate and distribute to students so they may use the information as a guide for specific jobs.
	Use filmstrips transparencies, and slides to assist in the presentation of the procedures to follow when applying automotive finishes.
VI. Paint Failures (7)	Discuss the main causes of paint failures. Develop with students a checklist of things to follow which will reduce most painting problems. Duplicate and distribute to students. (Ref. A, pp. 106-107)
	Discuss the causes and methods of correcting common automotive refinishing problems. (Ref. A, pp. 67-69, 107-117; Ref. C, pp. 43-47; Ref. D, pp. 56-59; Ref. E, pp. 199-202)
	Develop panels for demonstration and discussion purposes that show the effects of: • *Improper sanding of undercoats on the durability of topcoats* • *Compounding on the color deviations of metallics* • *Improper air pressure during application on the color of topcoats*

CONTENT		INSTRUCTIONAL SUGGESTIONS
VI.	Paint Failures (7) (cont'd)	• *Improper thinning on the color of metallics* • *Evaporation rates on the color of metallics* • *Atomization on the hiding power of topcoats* (Ref. Panel Preparation Guides by PPG Industries) *Review periodically with the students the causes and methods of correcting common paint problems.*
VII.	Cleaning Procedures	
	A. Spray guns (8)	Demonstrate how to clean a spray gun and dispose of and store unused topcoats.
	B. Removal of Masking Materials (9)	Demonstrate how to remove masking materials from protected surfaces.
VIII.	Rubbing and Polishing a Finish (10)	Discuss the differences between and uses for rubbing and polishing compounds. (Ref. A, pp. 20-21; Ref. B, pp. 227-228; Ref. E, pp. 35-168) Demonstrate how to hand and machine rub and polish finishes with compounds in order to make them smooth and improve their luster. (Ref. A, pp. 21-22; Ref. B, pp. 227-228, Ref. D, pp. 39-40)
IX.	Waxing a Finish (11)	Show how to wax and polish a finish. *Have students practice preparing, matching, mixing, and applying different types of topcoats. Before students apply a finish to a vehicle, have each one practice applying lacquer and enamel topcoats to metal sheets (4' by 4') until he is able to produce a satisfactory job.* *Have students practice doing a variety of repair jobs on live cars until they acquire the proficiency of an entry worker. Check each student's work to see that proper procedures are being followed.* (Ref. B, p. 250)
	Final Steps	
	A. Reinstall Hardware (12)	Demonstrate how to replace any hardware that was removed prior to repainting.

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
B. Cleaning vehicle (13)	Discuss the importance of thoroughly cleaning the vehicle inside and out before returning it to the owner including: • Removing any overspray on vehicle • Vacuuming rugs and seats • Cleaning all chrome parts • Cleaning all windows • Dusting dash and luggage shelf • Washing and drying exterior of car (Ref. D, p. 41)
XI. Estimating (14)	Discuss the importance of making accurate estimates for refinishing jobs. Discuss and demonstrate how to make estimates for various kinds of refinishing jobs following commercially prepared guidelines. Discuss and demonstrate how to estimate paint jobs using the spot method. *Have students practice estimating the cost of different types of refinishing jobs. Review each student's estimate and give assistance when necessary to improve his or her accuracy.*

Review Discussion

1. Explain how to match a color already on a vehicle.
2. Explain why metallic finishes are difficult to match.
3. List three paint problems that are caused by thinners evaporating too fast and three paint problems caused by thinners evaporating too slowly.
4. Name five common paint problems and give the corrective procedures for each.
5. List the steps to follow when finishing a panel with acrylic enamel.
6. Explain how to compound an acrylic lacquer finish.
7. List five steps which would eliminate many common paint problems.
8. Explain how to estimate the price of a paint job using the book method.

DECORATIVE FINISHES

Explains the purposes of decorative finishes and how to apply decals and transfers and produce special finishes and effects

OBJECTIVES

At the completion of this unit students will be able to:

1 *Select and apply decals and transfers*

2 *Produce special finishes*

3 *Produce special effects*

CONTENT OUTLINE		INSTRUCTIONAL SUGGESTIONS
I.	Purpose	Discuss the purposes of decorative finishes and how they are produced Discuss the demand for decorative finishes. *This type of job represents only a small portion of the total work time of an automotive painter. Thus, these special skills should be developed after the students have become proficient in applying regular automotive finishes.*
II.	Decals and Transfers (1)	Explain and demonstrate how to remove an old decal and transfer and prepare the surface for a new application. Explain and demonstrate how to select and apply a decal and a transfer to a vehicle. (Ref. A, pp. 80, 82)*
III.	Special Finishes (2)	Explain and demonstrate how to prepare and prime the surface of a vehicle prior to applying a special finish. (Ref. A, pp. 83, 87) Explain and demonstrate how to produce special finishes. (Ref. A, pp. 83-84, 87-88)
IV.	Special Effects (2)	Explain and demonstrate how to prepare and prime the surface of a vehicle prior to producing a finish with special effects. (Ref. A, pp. 87-88)

*Reference citations are shown on page 45.

CONTENT OUTLINE	INSTRUCTIONAL SUGGESTIONS
IV. Special Effects (3) (cont'd)	Explain and demonstrate how to produce special effects such as: • Shading • Blending • Scrolling • Striping — pin, racing • Lacing • Simulating vinyl roofing • Spider webbing • Fish scaling (Ref. A, pp. 88-90) Discuss the purpose of clear coating. (Ref. A, p. 80) Demonstrate how to apply a clear coat. (Ref. A, p. 80)

Review Discussion

1. Explain how to remove an old decal.
2. Explain how to prepare a surface for the application of a new decal.
3. Explain how to apply a decal.
4. Explain how to apply a wood-grain transfer.
5. Explain how to prepare the surface for a special finish.
6. Explain how to produce a special finish such as candy glow.
7. Explain how to produce a lacing effect.
8. Explain the purpose of applying a clear coat.

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SAMPLE FINAL EXAMINATION

Sample Final Examination Part I — Fill-In Statements

Directions: For each statement, write the word or phrase that, when inserted in the blank, will complete the statement correctly.

1. The color effects of a metallic finish is produced by METALLIC FLAKES.
2. When sanding a flat surface by hand, a painter should use a SANDING BLOCK.
3. Lacquers dry by EVAPORATION.
4. The purposes of the undercoat is to PROMOTE ADHESION and FILL IN SMALL FLAWS IN THE METAL.
5. The first step in refinishing a vehicle is to CLEAN THE SURFACE.
6. A squeegee is used to APPLY PUTTY and REMOVE WATER FROM A SURFACE.
7. A sticky cloth used to wipe a surface before paint is applied is called a TACK CLOTH.
8. One way to reduce the amount of compounding required of a lacquer finish is to apply it AS WET AS POSSIBLE WITHOUT SAGS OR RUNS.
9. The purpose of compounding a lacquer finish is to IMPROVE THE GLOSS.
10. Air transformers should be drained daily to PREVENT WATER FROM COLLECTING IN THE AIR SYSTEM.
11. The purpose of an air regulator is to give CONSTANT PRESSURE TO THE SPRAY GUN.
12. A mild texture in the surface of an enamel finish is called ORANGE PEEL.
13. The three ingredients of an automotive finish are the pigment, BINDER, and SOLVENT.
14. Four types of undercoats are primers, sealers, PRIMER-SURFACERS, and PUTTY.
15. When spraying lacquer, the distance from the surface that a painter should hold the spray gun is about 6 TO 8 INCHES.
16. A very light coat which is applied last is called a (an) MIST COAT.

17. Two causes of orange peel are too high an air pressure and SPRAY GUN HELD TOO FAR AWAY FROM THE SURFACE.

18. Tapering the broken paint film from the topcoat to the bare metal is called FEATHEREDGING.

19. Two types of spray guns are the pressure pot and SUCTION.

20. Three uses of a metal conditioner are to remove rust and corrosion, ETCH SURFACE TO IMPROVE ADHESION, and REDUCE FURTHER RUSTING.

21. Finishes need to be stirred to mix the pigment properly in order to insure a (an) GOOD COLOR MATCH.

22. The best temperature for spraying a vehicle is 70°F.

23. Acrylic lacquer finishes are used on new cars made by GENERAL MOTORS.

24. The main reason for using putty is to COVER SMALL IMPERFECTIONS.

25. When using a disc sander for paint removal, the mechanic should always WEAR SAFETY GLASSES.

Sample Final Examination Part II — Multiple Choice

Directions: For each statement, place the letter of the choice that completes the statement most accurately in the space to the left of the statement.

C 1. After spraying with enamel, the masking tape should be removed

(A) immediately
(B) within two hours
(C) the next day
(D) when the finish is dry to touch

B 2. After sanding, a bare metal surface should be treated with

(A) paint solvent
(B) conditioner
(C) reducer
(D) retarder

C 3. The grit number of the abrasive paper to use when final sanding a primer-surfacer is

(A) 120
(B) 220
(C) 400
(D) 500

B 4. A lacquer topcoat can be applied over

(A) new enamel finish
(B) primer-surfacer
(C) bare metal
(D) zinc chromate primer

C 5. Masking tape should not be applied at temperature below

(A) 75° F
(B) 60° F
(C) 50° F
(D) 32° F

D 6. Synthetic enamels dry by

(A) evaporation of solvent only
(B) oxidation of binder only
(C) evaporation of binder only
(D) evaporation of solvent and oxidation of binder

B 7. Spraying patterns can be affected by

(A) humidity
(B) clogged vent
(C) low temperature
(D) high temperature

D 8. The conditions which promote fast drying are

(A) cold and humid
(B) cold and dry
(C) hot and humid
(D) hot and dry

B 9. The too rapid evaporation of the thinner or reducer from a finish causes

(A) sandscratch swelling
(B) orange peel
(C) spot repair rings
(D) fish eyes

D 10. Thinners and reducers are used to

(A) improve the gloss finish
(B) reduce rusting of the metal
(C) promote adhesion of the topcoat
(D) increase the ability of a finish to flow out and level

B 11. Commercially prepared metallics are often called a

(A) luster finish
(B) color effects finish
(C) color finish
(D) special finish

A 12. To produce a wetter spray, the mechanic should

(A) decrease the distance the gun is held from the surface
(B) increase the distance the gun is held from the surface
(C) increase the speed of the strokes
(D) decrease the size of the spray pattern

C 13. When applying an enamel finish, the distance from the surface that the painter should hold the spray gun is about

(A) 4 to 6 inches
(B) 6 to 8 inches
(C) 8 to 10 inches
(D) 10 to 12 inches

C 14. When properly applied, the mist coat

(A) improves the color of the topcoat
(B) increases the drying time of the topcoat
(C) improves the flow out of the topcoat
(D) protects the topcoat

A 15. The use of a fish eye additive in a finish reduces the formation of

(A) craters
(B) crazing
(C) orange peel
(D) blushing

A 16. The peeling of a paint film from a surface shortly after being applied is caused by

(A) improper cleaning methods
(B) poor quality materials
(C) poor metalwork
(D) improper spraying techniques

B 17. During the painting of a vehicle, the radio antenna should be masked by covering it with

(A) grease
(B) a sleeve of paper
(C) masking tape
(D) thinner

D 18. To avoid differences in finish gloss or holdout when painting over surfaces repaired with a primer or putty, the painter should

(A) apply an alkyd enamel
(B) apply a tack coat of paint
(C) spray a wash coat of surfacer
(D) apply a sealer

C 19. The grit number of the abrasive paper to use when starting to featheredge a spot is

(A) #16
(B) #24
(C) #80
(D) #220

A 20. The purpose of the primer-surfacer is to

(A) fill minor surface flaws and promote adhesion
(B) reduce rusting of the metal
(C) promote color holdout
(D) remove grease and oil from the surface

C 21. To prevent a finish from blushing on a hot, humid day the painter should

(A) stop painting
(B) use a fast, dry thinner with retarder
(C) use a slow, dry thinner with retarder
(D) use a mist coat of retarder

B 22. When repairing an acrylic lacquer finish with a deep scratch, the painter should

(A) sand the surface, blow off dust, prime, and apply a color coat
(B) clean the surface chemically, featheredge, prime, sand, seal, and apply color coats
(C) sand the surface, wipe clean, seal, and apply color coats
(D) clean the surface chemically, prime, sand, seal, and apply color coats.

D 23. The purpose of the spreader adjustment valve on a spray gun is to

(A) adjust the amount of paint flow
(B) determine the correct spraying pressure
(C) atomize the paint mixture
(D) regulate the pattern adjustment

A 24. During spot refinishing with metallic colors, the darkest shade of a color is produced by holding the spray gun

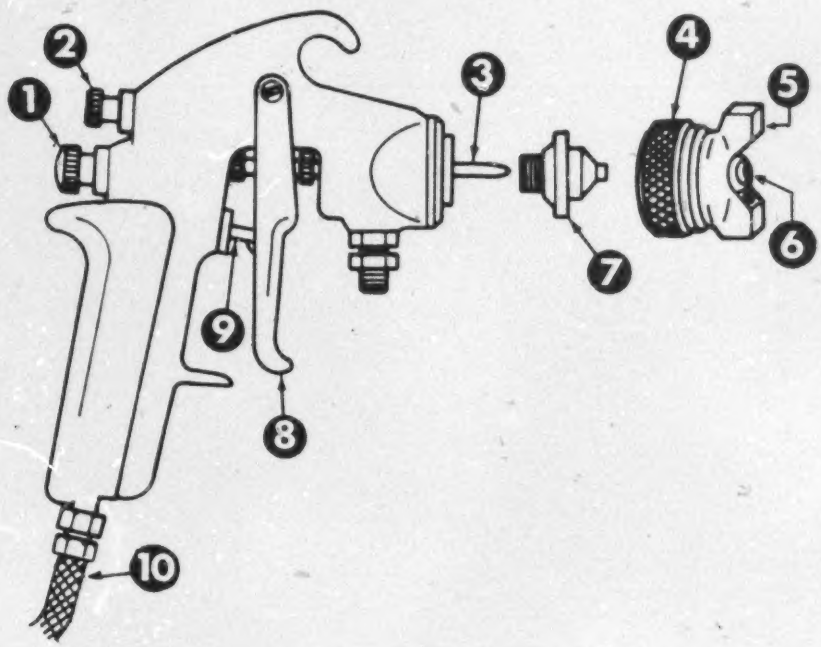
(A) close to the surface and moving it slowly
(B) close to the surface and moving it rapidly
(C) away from the surface and moving it slowly
(D) away from the surface and moving it rapidly

B 25. The procedure to use when refinishing with acrylic lacquer is to apply

(A) a single heavy coat
(B) three or four wet double coats
(C) a heavy coat and a mist coat
(D) a medium coat followed by a full second coat

Sample Final Examination Part III — Identification

Directions: In the space provided after each number, write the correct name of the part indicated by the matching number on the illustration given below.



1. FLUID CONTROL
2. PATTERN CONTROL
3. FLUID NEEDLE VALVE
4. AIR CAP
5. AIR HORN
6. NOZZLE
7. FLUID TIP
8. TRIGGER
9. AIR VALVE
10. AIR HOSE

Sample Final Examination Part IV — Problems

1. *Directions:* For each spray pattern shown below, write in the appropriate column one cause and one method of correction.

Spray Pattern	Cause	Correction

2. *Directions:* For each paint problem listed below, write in the appropriate column two causes and two methods of prevention.

Paint Problem	Causes	Prevention
Blistering		
Checking		
Lifting		
Peeling		
Wrinkling		

3. *Directions:* From the list given below, number in the correct order in the space provided the steps a painter would follow when he makes a spot repair using acrylic lacquer. Cross out any unnecessary steps.

(No) Wash the car

(5) Use spot putty to fill nicks and scratches

(11) Spray a light coat of paint on the area

(2) Featheredge finish around damaged area

(10) Clean compounded area with solvent

(7) Respray with primer-surfacer

(No) Spray five coats of primer-surfacer

(3) Treat exposed metal surface with metal conditioner

(1) Clean the surface around the damaged area with solvent

(6) Sand undercoat using block

(No) Sand old finish with 360 grit abrasive paper

(9) Compound damaged area

(4) Spray damaged area with primer-surfacer

(8) Sand undercoat using block and 400 grit abrasive paper

(12) Spray wet coats of paint on damaged area extending out from edge and flashing between coats

4. *Directions:* In the space provided to the left of the steps given below, number in the correct order the sequence which a painter would follow when completely refinishing a vehicle in same color. Cross out any unnecessary steps.

(5) Paint left doors

(2) Paint right front fender

(No) Always start painting from front of the car

(8) Paint right quarter panel

(1) Paint turrett top

(No) Leave door jams slightly ajar after painting hidden edges

(3) Paint hood panel

(6) Paint left quarter panel

(9) Paint right doors

(No) Reverse procedure for second coat

(4) Paint left front fender

(7) Paint trunk lid

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USING AUDIOVISUAL MATERIALS

Audiovisual materials are both a tool for teaching and an avenue for learning. Commercially made films, filmstrips, film loops, and slides may be used to supplement the regular instruction. Titles of some of these items are listed in the bibliography.

Photographic technology has advanced to a level where it is possible, with relative ease, to produce your own slides, movies, or filmstrips. Even sound and automation are easily added. Also, many schools have adequate audiovisual facilities and skilled personnel so that an instructor is able now to create and produce his own audiovisual aids.

The first step might be the development of a set of 2 by 2 inch slides to assist in presenting a complex procedure. Slides are inexpensive; simple to make; and can be organized, rearranged, and updated very easily. Also, slides are equally well suited for individual use or group presentation.

Slides may be used by individual students for review of material already presented or by students who missed the original presentation. When used on an individual basis, the slides permit the student to progress at his own pace. Such individual use requires the development of a printed script and directions to guide the student through the materials and to emphasize the important concepts related to the topic.

File cards may be used to plan the slides and accompanying script. Place each fact or idea in the lower one-third of a file card. Include a summary of the purpose of the slide or statement that will be said when the slide is projected. Use the upper portion of the card to make a visual representation of the slide itself. Let the slide carry the message, and add only enough script to clarify what is being shown. Review the cards and make necessary revisions. Keep the content of each slide simple and limited to one point or concept. Titles and captions should be a part of every presentation. Limit the title slides to less than 15 words. Use dry-transfer or three-dimensional letters that are at least three-eights of an inch high in order to be legible when projected.

Good slides can be produced with an inexpensive, automatic, single lens reflex camera and color film. Additional light for shop setups can be obtained by using electronic flash, flash bulbs, or photoflood lamps. Easily attached close-up lenses might be helpful when photographing small parts or showing fine details. Bracket the exposure to be sure of getting a usable slide and thus eliminate the work of making the setup over again. A tripod will be necessary to hold and position the camera for many of the pictures. Obtain additional assistance for your project from the local Director of Educational Communications.

GLOSSARY

Acrylic resins: Synthetic resins used in lacquers and enamels to provide durability and retention of color and gloss.

Adhesion: The ability of one substance to stick to another.

Air dry: The process of drying paint under normal room temperature.

Alligatoring: The formation of small cracks in the surface of a finish.

Aluminum oxide: An abrasive substance used to smooth a surface.

Atomization: The process of reducing paint to small particles.

Binder: The part of a paint that holds the pigment particles together.

Bleeding: The staining of one finish with the color of an older finish which is underneath.

Blistering: The formation of bubbles on the surface of a finish.

Blushing: A milky or misty appearance of a finish.

Body: The viscosity or degree of thickness of a liquid.

Bronzing: The formation of a metallic-appearing haze on a finish.

Build: The thickness of the film of paint on a surface.

Chalking: The formation of a powder on the surface of a finish caused by the weathering of the paint.

Checking: The formation of small cracks in the surface of a finish.

Chipping: Small pieces of the topcoat breaking away from the rest of the finish.

Color retention: The ability of finish to keep its original color.

Compatibility: The ability of two or more substances to work together.

Contaminants: Surface materials which adversely affect the quality of the finish that is applied.

Coverage: The surface that a given quantity of paint will cover.

Cratering: The formation of small holes in a finish caused by surface contamination.

Crazing: The formation of small cracks in the surface of a finish.

Curing: The final drying stage by which a finish reaches its full strength.

Decalcomania (decal): A picture, design, or lettering on an enamel film that can be transferred to a surface.

Die back: The loss of luster in a topcoat caused by the continued evaporation of the thinner after the finish has been compounded.

Double coat: A pass of the spray gun followed immediately by another pass.

Drier: A catalyst added to a finish to reduce drying time.

Dry spray: The part of the finish that does not dissolve into the material being sprayed.

Enamel: A type of finish that dries by evaporation of the solvents and the oxidation of the binder.

Featheredging: The tapering of a finish from the topcoat to the bare metal surface.

Fish eyes: Small holes that form in the surface of a finish.

Flash: The first stage of drying when the finish changes from a wet glossy appearance to a normal glossy look.

Flow: The ability of the particles of paint to come together and form a smooth surface.

Fog coat: A very thin and highly atomized color coat used to obtain a minimum penetration of the thinner into the old finish.

Gloss: The ability of a surface to reflect light.

Hiding: The ability of a paint to obscure the surface to which it is applied.

Holdout: The ability of the undercoat or sealer to keep the topcoat from sinking in.

Lacquer: A type of finish that dries by evaporation.

Lifting: Damage to a finish caused by poorly cleaned surfaces, residues of silicone-type polishes, and solvents in the finish reacting to a previously painted surface.

Masking: Protecting surfaces that should not be painted.

Metal conditioner: An acid-type substance used to clean unfinished metal and prevent further rusting.

Metallic finishes: A type of finish that includes metal flakes in addition to the pigment.

Mist coat: A finish that contains a high preparation of a slow-evaporating thinner and little or no color.

Mottling: The condition of a metallic finish when the metal flakes float together and form a spotty effect.

Orange peel: A finish with a textured appearance caused by the failure of the panel droplets to flow together.

Overspray: Dry particles of spray paint on areas where they are not wanted.

Pigment: Small, finely ground, undissolved particles that are used to give color to a finish.

Polishing compound: A very fine abrasive material used to polish a finish.

Primer: An undercoat applied to a metal surface to improve the adhesion of the topcoat.

Primer-surfacer: A primer or undercoat that is used to fill small imperfections in the metal surface.

Putty: A material used to fill flaws which are not filled by a primer-surfacer.

Reducer: A solvent used to thin enamels.

Retarder: A slow-drying solvent used to reduce the rate of evaporation.

Rubbing compound: A fine abrasive material used to smooth a finish.

Sags: A finish that runs or drips after being applied to a surface.

Sandscratches: Marks made in the metal or old finish by abrasive materials.

Sand-scratch swelling: Solvents from the topcoat getting into sand scratches in the old finish and causing them to swell.

Sealer: A coating applied to a surface that is used to prevent a previous finish from bleeding through and to improve the adhesion and holdout qualities of the topcoat.

Silicon carbide: An abrasive substa ce used to smooth and polish a surface.

Silicone: An ingredient in waxes which makes them smooth to touch and the main cause of fish eyes in a finish.

Single coat: One pass of the spray gun which overlaps the previous pass by about 50 percent.

Solvent: A liquid that dissolves, dilutes, or liquifies another liquid or a solid.

Squeegee: A rubber pad or block used to wipe off wet sanded areas or apply putty.

Substrate: The surface that is to be finished.

Tack cloth: A cloth saturated with nondrying varnish that is used to remove dust and dirt particles from a surface.

Thinner: A solvent used to thin lacquers.

Undercoat: Material used to make a smooth base for the topcoat.

Water spotting: Damage to a finish caused by water droplets on the surface before the finish is completely cured.

Wrinkling: Small ridges in a finish caused by the top portion of the paint film drying ahead of the bottom portion.

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